We claim:

1. A copolymer of ethylene with α-olefins which has a molar mass distribution M_w/M_n of from 1 to 8, a density of from 0.85 to 0.94 g/cm^3, a molar mass M_n of from 10 000 g/mol to 4 000 000 g/mol and a CDBI of less than 50% and in which the side chain branching of the maxima of the individual peaks of the side chain branching distribution is in each case greater than 5 CH_3/1 000 carbon atoms.

2. A copolymer of ethylene with α-olefins as claimed in claim 1 which has an at least bimodal side chain branching distribution.

3. A copolymer of ethylene with α-olefins as claimed in claim 1 or 2 which has a molar mass M_n of from 150 000 g/mol to 1 000 000 g/mol.

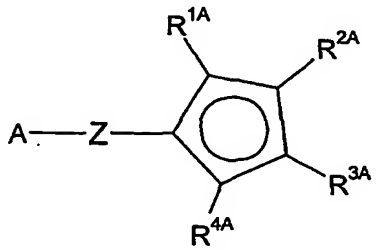
4. A copolymer of ethylene with α-olefins as claimed in any of claims 1 to 3 which has at least one peak in the Crystaf® spectrum of the differential distribution in the range from 15 to 40°C and at least one further peak in the Crystaf® spectrum of the differential distribution in the range from 25 to 80°C.

5. A copolymer of ethylene with α-olefins as claimed in any of claims 2 to 4 in which the side chain branching distribution is bimodal or trimodal.

6. A process for preparing ethylene copolymers as claimed in any of claims 1 to 5, which comprises polymerizing ethylene with α-olefins in the presence of the following components:

   A) at least one monocyclopentadienyl complex comprising the structural feature of the formula (Cp–Z-A)Cr (I), where the variables have the following meanings:

      Cp-Z-A is a ligand of the formula (II)

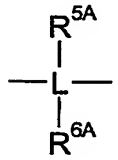


(II)

      where

R^{1A}-R^{4A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part, NR^{11A}_2, $N(SiR^{11A}_3)_2$, OR^{11A}, $OSiR^{11A}_3$, SiR^{11A}_3, BR^{11A}_2, where the organic radicals R^{1A}-R^{4A} may also be substituted by halogens and where at least two of the vicinal radicals R^{1A}-R^{4A} are joined to form a five- or six-membered ring, and/or two vicinal radicals R^{1A}-R^{4A} are joined to form a heterocycle which contains at least one atom from the group consisting of N, P, O and S,

Z is a bridge between A and Cp having the formula

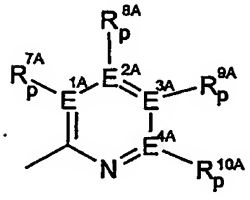


where

L is carbon or silicon, preferably carbon,

R^{5A},R^{6A} are each hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11A}_3, where the organic radicals R^{5A} and R^{6A} may also be substituted by halogens and R^{5A} and R^{6A} may also be joined to form a five- or six-membered ring,

A is



(III)

where

E^{1A}-E^{4A} are each carbon or nitrogen,

R^{7A}-R^{10A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11A}_3, where the organic radicals R^{7A}-R^{10A} may also bear halogens or nitrogen or further C_1-C_{20}-alkyl groups, C_2-C_{20}-alkenyl groups, C_6-C_{20}-aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11A}_3 as substituents and two

vicinal radicals R^{7A}-R^{10A} or R^{7A} and Z may also be joined to form a five- or six-membered ring,

R^{11A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two geminal radicals R^{11A} may also be joined to form a five- or six-membered ring and

p is 0 when E^{1A}-E^{4A} is nitrogen and is 1 when E^{1A}-E^{4A} is carbon,

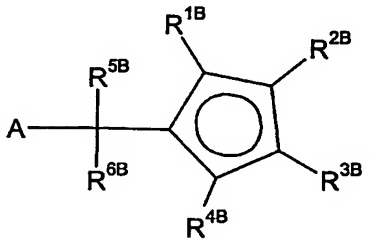
B) optionally an organic or inorganic support,

C) optionally one or more activating compounds and

D) optionally one or more metal compounds containing a metal of group 1, 2 or 13 of the Periodic Table.

7. A catalyst system for olefin polymerization comprising

A') at least one monocyclopentadienyl complex A') comprising the structural feature of the formula (Cp– $CR^{5B}R^{6B}$ -A)Cr (IV), where the variables have the following meanings:

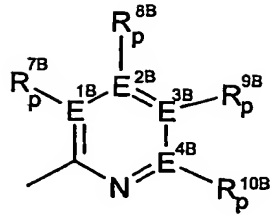
Cp-$CR^{5B}R^{6B}$-A is 

(V)

where

R^{1B}-R^{4B} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl radical and 6-20 carbon atoms in the aryl radical, NR^{5A}_2, $N(SiR^{11B}_3)_2$, OR^{11B}, $OSiR^{11B}_3$, SiR^{11B}_3, BR^{11B}_2, where the organic radicals R^{1B}-R^{4B} may also be substituted by halogens and two vicinal radicals R^{1B}-R^{4B} may also be joined to form a five- or six-membered ring,

R^{5B},R^{6B} are each hydrogen or methyl,

A is  (VI)

where

E^{1B}-E^{4B} are each carbon or nitrogen,

R^{7B}-R^{10B} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3, where the organic radicals R^{7B}-R^{10B} may also bear halogens or nitrogen or further C_1-C_{20}-alkyl groups, C_2-C_{20}-alkenyl groups, C_6-C_{20}-aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 as substituents and two vicinal radicals R^{7B}-R^{10B} may also be joined to form a five- or six-membered ring,

R^{11B} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals R^{11B} may also be joined to form a five- or six-membered ring,

p is 0 when E^{1B}-E^{4B} is nitrogen and is 1 when E^{1B}-E^{4B} is carbon,

where at least one radical R^{7B}-R^{10B} is C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 and the organic radicals R^{7B}-R^{10B} may also bear halogens or nitrogen or further C_1-C_{20}-alkyl groups, C_2-C_{20}-alkenyl groups, C_6-C_{20}-aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{5C}_3 as substituents and two vicinal radicals R^{7B}-R^{10B} may also be joined to form a five- or six-membered ring or at least one E^{1B}-E^{4B} is nitrogen,

B) optionally an organic or inorganic support,

C) optionally one or more activating compounds and

D) optionally one or more metal compounds containing a metal of group 1, 2 or 13 of the Periodic Table.

8. A catalyst system for olefin polymerization as claimed in claim 7, wherein two vicinal radicals R^{1B}-R^{4B} in the monocyclopentadienyl complex A') form a fused ring system.

9. A prepolymerized catalyst system comprising a catalyst system as claimed in claim 7 or 8 and linear C_2-C_{10}-1-alkenes polymerized onto it in a mass ratio of from 1:0.1 to 1:200.

10. The use of a catalyst system as claimed in any of claims 7 to 9 for the polymerization or copolymerization of ethylene with α-olefins.

11. A process for preparing ethylene copolymers as claimed in any of claims 1 to 4, which comprises polymerizing ethylene with α-olefins in the presence of a catalyst system as claimed in any of claims 7 to 9.

12. A process as claimed in claim 11, wherein the polymerization is carried out using, as monomers, a monomer mixture which comprises ethylene and/or C_3-C_{12}-1-alkenes and contains at least 50 mol% of ethylene.

13. A polymer mixture comprising
(E) from 1 to 99% by weight of one or more ethylene copolymers as claimed in any of claims 1 to 5 and
(F) from 1 to 99% by weight of a polymer which is different from (E),
where the percentages by weight are based on the total mass of the polymer mixture.

14. A fiber, film or molding comprising an ethylene copolymer as claimed in any of claims 1 to 5.